

Pascal's Law - Hydraulics

Questions

Use information from the text to support your answer

1) What is Pascal's Law? Explain how it relates to hydraulic systems.

Within a closed system, pressure acts in all directions (on all surfaces). This means that if you push on one surface (piston or pump) it will push another piston too. If the piston is larger, the pressure creates a bigger force.

2) How does a hydraulic system work?

As the pressure increases, the pressure acts and moves the cylinder since the fluid transfers the force and creates movement.

Word Problems

Answer the word problems below.

1)

Shane is using a hydraulic system to lift a car that weighs 1800 kg. The area of the slave piston is 120 cm² and the area of the master piston is 20 cm². How much force does he need to put into the handle?

$$P = \frac{F}{A}$$

$$\text{Hydraulic Advantage} = \frac{A_1}{A_2}$$

∴ you would need 300kg of force.

$$F = \frac{\text{Weight}}{\text{Hydraulic Advantage}}$$

$$= \frac{1800 \text{ kg}}{6}$$

$$= 300 \text{ kg}$$

$$= \frac{120 \text{ cm}^2}{20 \text{ cm}^2}$$

$$= 6$$

2)

Sheena pushes on the breaks to stop her car. She applies 20kg^{F₁} of force to the pedal, which is connected to a master piston that is 35 cm²_{A₁}. The brake pads are connected to a slave piston that has an area of 280 cm²_{A₂}. How much force did she apply into the brake pads?

$$HA = \frac{A_2}{A_1}$$

$$= \frac{280 \text{ cm}^2}{35 \text{ cm}^2}$$

$$= 8$$

$$F_2 = F_1 \times HA$$

$$= 20 \text{ kg} \times 8$$

$$= 160 \text{ kg}$$

∴ Sheena applied 160kg into the brake pads.

